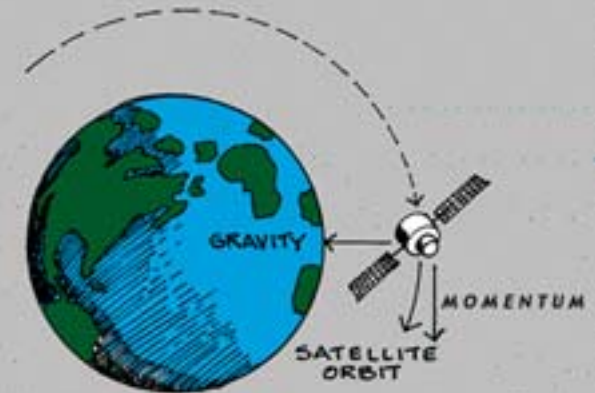


# Satellites and Orbits: an Introduction

## Classroom Demonstration

Discover how a satellite stays in orbit.

1. Materials that you will need:
  - String (about 3' long), nylon netting (approximately 1 sq. ft.), small rubber ball (2" – 3" diameter)
2. Cut a piece of nylon netting and place it around the rubber ball to form a "bag" to hold the ball.
3. Tie one end of a 3-foot length of string securely around the nylon mesh to close off the bag holding the ball.
4. Hold the other end of the string in your hand and begin to whirl the ball in a circle around your head.
  - When you whirl the ball in a circle around your head, the ball is held in its "orbit" by the string. You must constantly pull on the string to keep the ball from flying off in a straight line. The force you apply to the ball through the string is the **Centripetal Force**.
  - Similarly, for a satellite that is in orbit around the Earth, it is the Earth's **Gravity** that exerts a **Centripetal Force** on the satellite that prevents it from flying off into space. The Earth's **Gravity** pulls on the satellite like you pull on the string to keep the ball whirling around your head.
  - The forward motion of the ball is its momentum. The swinging of the ball gives the ball its forward motion. If you were not pulling constantly on the string, the ball would continue to fly off in a straight line. However, the **Centripetal Force** exerted by you pulling on the string accelerates the ball inward towards you. This acceleration causes the ball to continuously change its direction from a straight line. The ball remains in a circular "orbit" around your head without falling into or flying away from you.
  - A satellite's forward motion is controlled by rockets. When the rockets are not fired, inertia keeps the satellite going in one direction. The Earth's **Gravity** exerts a **Centripetal Force** on the satellite that causes the satellite to accelerate towards the Earth and continuously change direction as the satellite orbits the Earth.
5. Let go of the string.
  - What happens? (The ball flies outward, because the Centripetal Force [Gravity] is now equal to zero.)
6. Discuss other examples of momentum and gravity: for example, swinging a bucket of water over your head without getting drenched; or riding amusement park rides where you turn upside down or move vertically in a loop without falling out.



Adapted from: Gulf of Maine Aquarium - <http://octopus.gma.org/surfing/satellites/inorbit.html>  
Teacher's Domain - <http://www.teachersdomain.org/6-8/sci/phys/mfw/zcentrip/>  
The Physics Classroom - <http://www.physicsclassroom.com/mmedia/circmot/ucm.html>  
Imagine the Universe - <http://imagine.gsfc.nasa.gov/YBA/cyg-X1-mass/more-circular.html>